United States Patent [19]

Cub et al.

[11] **3,739,916**

[45] **June 19, 1973**

[54] **FILTER ELEMENT FOR FILTERING OF LIQUIDS**

[75] Inventors: **Fritz Cub**, Schwabach; **Paul Kleinert; Heinz Lammermann**, both of Nuernberg; **Hans Schacht**, Stuttgart, all of Germany

[73] Assignee: **Robert Bosch G.m.b.H.**, Stuttgart, Germany

[22] Filed: **May 4, 1971**

[21] Appl. No.: **140,059**

[30] **Foreign Application Priority Data**

Aug. 8, 1970 Germany ..... P 20 39 482.5

[52] **U.S. Cl.** **210/493**, 210/497

[51] **Int. Cl.** **G01d 27/06**

[58] **Field of Search** 210/494, 493; 161/102, 108, 133, 135, 137

[56] **References Cited**

UNITED STATES PATENTS

2,599,604	6/1952	Bauer et al.	210/494
3,025,963	3/1962	Bauer	210/493
668,101	2/1901	Hinde	161/133

FOREIGN PATENTS OR APPLICATIONS

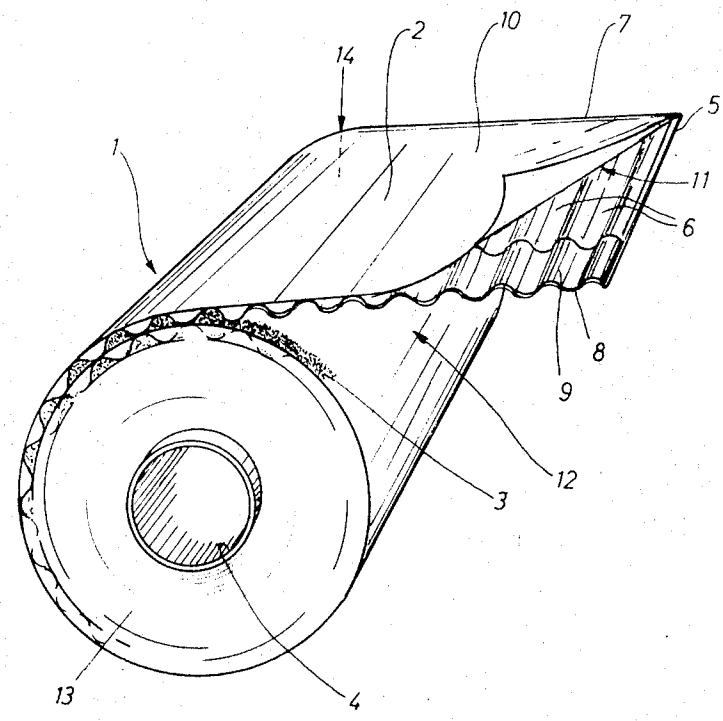
699,168	10/1953	Great Britain	210/494
755,481	8/1956	Great Britain	210/494
1,222,727	6/1960	France	210/493
1,094,978	5/1955	France	210/493

Primary Examiner—Samih N. Zaharna
Assistant Examiner—F. F. Calvetti
Attorney—Michael S. Striker

[57] **ABSTRACT**

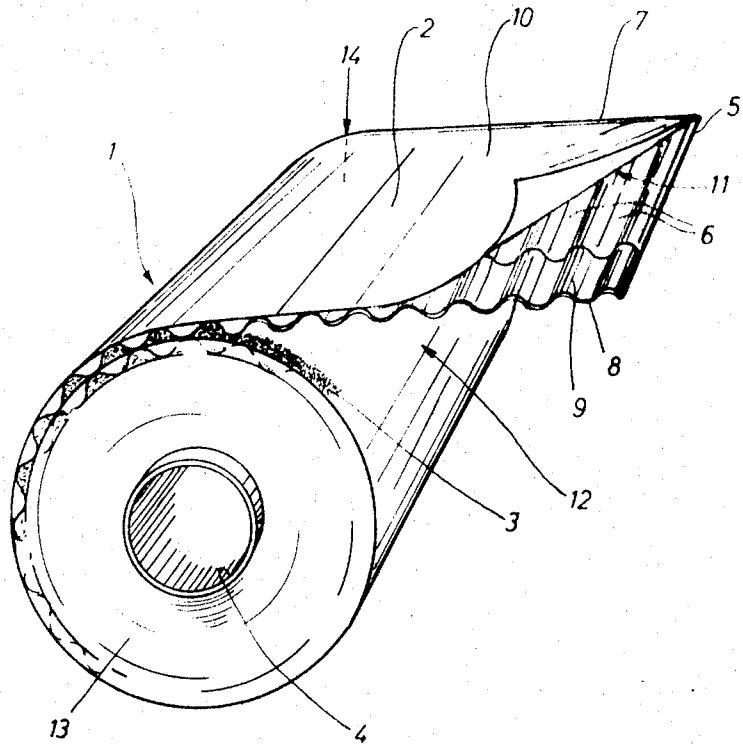
A coiled strip of filter material includes a pair of superimposed longitudinally coextensive strip portions each having a longitudinally extending free edge and a transversely spaced connected edge connected with the respectively other strip portion. A plurality of at least substantially parallel transverse corrugations is provided in only one of these strip portions and the convolutions of the coiled strip define with one another two spirally intercalated internal filter chambers one of which is open at one axial end of the coil and the other of which is open at the other axial end of the coil.

9 Claims, 1 Drawing Figure



PATENTED JUN 19 1973

3,739,916



INVENTORS:
Fritz CUB
Paul KLEINERT
Heinz LÄMMERMANN
Hans SCHACHT
BY
Michael I. Shall
Their ATTORNEY

FILTER ELEMENT FOR FILTERING OF LIQUIDS

BACKGROUND OF THE INVENTION

The present invention relates generally to a filter element, and more particularly to a filter element for filtering of liquids.

It is already known to provide a coiled filter element by convoluting a strip of filter material which is first folded to a substantially V-shaped configuration so as to have two superimposed strip portions, both of which are provided with transversely extending corrugations which serve to compensate for length variations in the individual strip portions during the convoluting of the filter strip to a coiled configuration.

In this prior-art construction the strip is first folded so as to provide two superimposed strip portions, and is only then provided in suitable manner — as by embossing or the like — with the transversely extending corrugations. The strip itself usually consists of paper and when the corrugations are formed the structure of the paper is affected in both strip portions. This can be disadvantageous under certain circumstances. Furthermore, the prior-art construction requires additional components for maintaining adjacent convolutions of the coiled strip element spaced from one another to permit the flow of liquid through the thus-obtained spaces. On one axial end adjacent convultions are also connected with one another by a suitable adhesive to provide two spirally intercalated filter chambers which are open from opposite axial ends of the coil. However, in the prior-art construction the corrugated depressions in both strip portions of the filter strip make it possible for accummulations of adhesive to occur locally which is also undesirable. Finally, the provision of corrugations in both strip portions which are superimposed upon one another is more difficult and requires greater care in operation than this is necessary if there are to be provided in only a strip or strip portions of single thickness rather than dual thickness.

SUMMARY OF THE INVENTION

It is, accordingly, an object of the present invention to further improve the aforementioned prior-art filter element.

More particularly, it is an object of the present invention to provide an improved filter element of the type here under discussion which is still simpler than what is known from the art, which is therefore less expensive and which is fully satisfactory for the operational requirements which are made of it.

A concomitant object of the invention is to provide such an improved filter element which offers itself readily for manufacture by automated production methods.

In pursuance of the above objects, and others which will become apparent hereafter, one feature of the invention resides in a filter element for filtering of liquids which, briefly stated, comprises a coiled strip of filter material including a pair of superimposed longitudinally coextensive strip portions each having a longitudinally extending free edge and a transversely spaced connected edge connected with the respectively other strip portion. A plurality of at least substantially parallel transverse corrugations are provided in only one of these strip portions and the convolutions of the coiled strip define two spirally intercalated internal filter chambers one of which is open at one axial end of the coil and the other of which is open at the other axial end of the coil. The corrugations compensate for length variations in one of the strip portions relative to the other strip portion which occur due to convoluting of the strip to coiled shape.

The fact that in the filter element of the present invention only one of the strip portions is provided with corrugations does not mean that the other strip portion need be entirely smooth or planar. However, according to the invention it will not be provided with corrugations as is the other strip portion.

By resorting to the construction according to the present invention, several advantages are obtained. Firstly, when the corrugations are formed only the paper structure of the one strip — it is understood that the strip will normally be again made of paper — will be affected by the provision of the corrugations, whereas the paper structure of the other strip portion remains unchanged. The corrugations still serve the purpose of providing a compensation for length variations which occur between the respective strip portions during convoluting of the strip to coil shape. In addition, however, the corrugations in the one strip portion in conjunction with the fact that the other strip portion is not provided with such corrugations, serve thus to act in effect as spacers maintaining adjacent convolutions spaced from one another and also maintaining the strip portions spaced from one another, without requiring separate components for this purpose as is known from the prior art. In addition, the corrugations reinforce the material of the strip, making it possible to readily roll the strip composed of the superimposed strip portions to spiral configuration without requiring any auxiliary supporting components. Because of the regular and even distribution of the corrugations, the application of adhesive for the purposes and in the manner already discussed, and still to be discussed further below, can be properly carried out without the local accumulation of excessive quantities of such adhesive, whereby the overall use of the adhesive is reduced. Because it is not necessary to provide separate spacing components in the coil, more filter paper can be provided — in form of the strip — in a predetermined volume of a coil than this is possible in accordance with the prior art. This means, for instance, that is a predetermined filter surface area is specified, the volume of the coil can be reduced.

It is particularly advantageous if that portion or strip portion which is provided with corrugations has a marginal section which is folded back upon the strip portion in question and extends along the free edge of the latter. In this manner, the free edge is reinforced and stiffened against bending, an advantage particularly with reference to adhesive connecting of adjacent convolutions of the strip in the coil made therefrom.

It is also advantageous if the strip is so convoluted to coil form that the strip portion provided with the corrugations faces inwardly towards the center of the coil whereas the non-corrugated strip portion faces outwardly away from the center. The advantage here is that during the convoluting the strip portion provided with the corrugations (and which is therefore readily yeildable) is subjected to the pressure resulting from the winding or convoluting operation. This means that for obtaining a predetermined depth of the corrugations in the completed filter element, the depth of the corrugations formed in the strip prior to convoluting of

the same, can be smaller that would otherwise be possible.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

The single FIG. is a perspective view illustrating a filter element according to the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to the drawing it will be seen that the coiled filter element is identified in toto with reference numeral **1.** Because the outer free end of the coiled element has been shown loosened from the remainder of the element, it is clearly visible that the element is composed of an elongated strip **2** which conventionally consists of filter paper and which is folded in half in substantially V-shaped configuration to provide two strip portions **5** and **10** which are longitudinally coextensive. The strip portion **5** is provided with a plurality of longitudinally arrayed transversely extending corrugations **6** which extend over the entire width of the strip portion **5** and which are arranged at regular intervals normal to the foldong edge **7** at which the strip portions **5** and **10** are connected with one another. The strip **1** is wound onto a center tubular element **4,** which may for instance consist of cardboard or the like, and adjacent ones of its convolutions are tightly and firmly connected with a thermoplastic adhesive **3.**

Each of the strip portions **5** and **10** has a free edge transversely spaced from the respective connected edge extending along the fold **7,** and the free edge **8** of the strip portion **5** is provided with a marginal section **9** which is folded back upon a corresponding section of the strip portion **5** so as — in this embodiment — to be located between the strip portion **5** and the strip portion **10.** The latter is essentially smooth, and not provided with corrugations, whereas the marginal section **9** provided with the same corrugations as the remainder of the strip portion **5** and serves the purpose of reinforcing and stiffening the edge **8,** making the corrugations **6** in this area resistant to deformation.

As the drawing shows, a strip of a thermoplastic adhesive **3** — which may be of suitable and already well known type — is arranged in the region of the free edge **8** between the corrugated strip portion **5** of any one convolution and the cooperating smooth strip portion **10** of the adjacent convolution of the spirally convoluted strip **2.** The purpose is to provide in the coil **1** two spirally intercalated filter pockets **11** and **12** one of which is open to and accessible from the axial end **13** whereas the other is open to and accessible from the axial end **14** of the coil. The chambers **11** and **12** are completely separated from one another. Due to the provision of the section **9** between the strip portions **5** and **10,** the chamber **11** has a larger volume than the chamber **12** to thereby provide adequate space for the deposition and retention of contaminants in a liquid which is to be filtered with the novel filter element, thus reducing the danger that the filter element might become clogged.

Of course, in conventional manner the filter element **1** will be inserted into a housing provided customarily for such filter elements, and sealed so that the axial end **13** is connected with a supply conduit and the axial end **14** with a withdrawal conduit. Intermediate these conduits the liquid to be filtered passes through the filter element **1** and is filtered.

To produce the novel filter element according to the present invention, a strip of suitable filter paper is first folded back upon itself along a section adjacent an edge, to thereby form the section **9.** Subsequently, the portion **5** provided with the section **9** is provided with corrugations extending transversely to the elongation of the strip and to the longitudinal center line thereof. corrugations **6** which are advantageously provided by passing the strip through a pair of camming and bossing gears which of course act only upon that half of the strip corresponding later to the strip portions **5.** Subsequently the strip is folded transversely to substantially V-shaped configuration in order to obtain the two strip portions **5** and **10.** Now, it is spirally convoluted about the center tubular element **4,** and the thermoplastic adhesive **3** is inserted between adjacent convolutions as the coil is being formed.

It is advantageous for the thermoplastic adhesive **3** to be supplied in viscous state through a nozzle onto the smooth strip portion **10** adjacent the free edge thereof, and to be pressed into the corrugations **6** during the convoluting so that it will solidify in these corrugations as it is allowed to cool off. The use of such a material makes it possible to obtain a seal-tight and also a strong connection between the two strip portions **5** and **10** even when they are spaced relatively far fron one another. Also, this material does not shrink on cooling and is chemically resistant particularly to liquid fuels.

The beginning end — which is secured to the center tubular element **4** — and the terminal end — which is shown loose in the drawing — are each sealed by an additional quantity of thermoplastic adhesive **3** extending along lines parallel to the corrugations **6.** The sealing and the tearing of the first or innermost convolution with reference to the tubular element **4** is achieved in that an increased quantity of thermoplastic material is applied precisely over the edge of the first convolution during the winding process, so that as the second convolution is wound over the first convolution, the grooves between the layers are filled and a residual quantity of the adhesive is pressed out at the axial end of the coil but in still highly viscous state, where it is engaged by means of special tools and is pushed axially into the first two coils to be allowed to cool in order to obtain a bounding and sealing action. Having the section **9** be located between the strip portions **5** and **10** assures during the winding of the strip **2** to the illustrated coil that the section **9** is compressed less in radial direction than the strip portion **5** with the corrugations **6** and will thus properly overlye the adjacent surface portions of the strp portions **5.**

The drawing illustrates the corrugations **6** to be of uniform cross-sectional configuration throughout. However, according to a further embodiment of the invention, it is also possible to so configurate the cross-section of the corrugations **6** that in the region of the free edge **8** of the strip portion **5** they are larger so that the combined cross-sectional areas of the open ends of

the corrugations located at the axial end **13** which is the inlet end of the finished filter element, is greater than the combined cross-sectional area of the ends of those corrugations which are sealed by the thermoplastic adhesive **3**. Even if this embodiment is chosen, however, the function of the corrugations **6** as spaces, as reinforcements, and for length-compensating purposes remains unaffected. It goes without saying that it is also possible to continuously vary the cross-sectional configuration of the corrugations **6**, from the free edge **8** to or towards the fold **7**. It will also be appreciated that according to an additional embodiment it is possible to have the corrugations **6** provided in the strip portion **10** and to have the strip portion **5** be smooth, which is to say that the strip **2** can be so wound that the strip portion provided with the corrugations will face outwardly away from the center tubular element **4** and the strip portion which is smooth will face inwardly towards this element. It is preferred to use as the starting material for the strip **2** a so-called crepe paper which is then further processed in the manner discussed above. However, it is of course equally well possible to use smooth non-creped paper and to process it further in the manner discussed above.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of constructions differing from the types described above.

While the invention has been illustrated and described as embodied in a filter element for filtering of liquids, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can, by applying current knowledge readily adapt it for various applications without omitting features, that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be protected by Letters Patent is set forth in the appended claims.

We claim:

1. A filter element for filtering of liquids, comprising a strip of filter material folded so as to form two closely adjacent strip portions consisting of one piece and having aligned longitudinally extending free edges and longitudinally extending second edges transversely spaced from the respective free edges, said strip portions being, due to said folding, unitary along said second edges only and said strip being coiled so that each of said strip portions forms a plurality of convolutions which alternate with the convolutions of the other strip portion, only one of said strip portions having a plurality of at least substantially parallel transverse corrugations which compensate for length variations due to coiling of said strip, the convolutions of said strip portions defining two spirally intercalated internal filter chambers one of which is open in the region of said free edges and closed in the region of said second edges due to said strip portions being folded and therefore unitary along said second edges; and means for closing the other of said intercalated internal filter chambers along said free edges of said strip portions, so that said intercalated internal filter chambers are open and closed along opposite edge of said strip portions, respectively.

2. A filter element as defined in claim **1**, said one strip portion including a marginal section extending along said free edge and folded back upon a corresponding section of said one strip portion.

3. A filter element as defined in claim **1**, said one strip portion facing inwardly toward the center of the coiled strip and the other of said strip portions facing outwardly away from said center.

4. A filter element as defined in claim **3**, said one strip portion including a marginal section extending along said free edge and folded back upon a corresponding section of said one strip portion so as to be located between the latter and the other of said strip portions.

5. A filter element as defined in claim **1**, wherein the combined cross-sectional area of said open end of said other corrugations exceeds the combined cross-sectional area of said open ends of said some corrugations.

6. A filter element as defined in claim **1**, said corrugations forming in the region of said free edge of said one strip portion a uniformly sinuous configuration.

7. A filter element as defined in claim **1**; further comprising a tubular center element about which said strip is convoluted; and adhesive means sealingly connecting the initial convolution of said strip with said center element.

8. A filter element as defined in claim **7**, wherein said adhesive means is thermoplastic means sealingly connecting said initial convolution with said center element at the opposite axial ends thereof.

9. A filter element as defined in claim **7**, wherein said tubular center element is a cardboard tube.

* * * * *